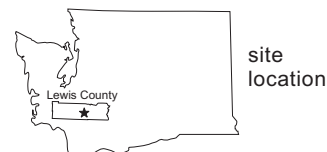


INACTIVE AND ABANDONED MINE LANDS — Roy and Barnum- McDonnell Mines, Morton Cinnabar Mining District, Lewis County, Washington

by Fritz E. Wolff,
Donald T. McKay, Jr.,
David K. Norman

WASHINGTON
DIVISION OF GEOLOGY
AND EARTH RESOURCES

Open File Report 2001-1
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WASHINGTON STATE DEPARTMENT OF
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WASHINGTON DEPARTMENT OF NATURAL RESOURCES

Doug Sutherland—*Commissioner of Public Lands*

DIVISION OF GEOLOGY AND EARTH RESOURCES

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Printed on recycled paper
Printed in the United States of America

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Inactive and Abandoned Mine Lands— Roy and Barnum-McDonnell Mines, Morton Cinnabar Mining District, Lewis County, Washington

Fritz E. Wolff, Donald T. McKay, Jr., and David K. Norman
Washington Division of Geology and Earth Resources
PO Box 47007; Olympia, WA 98504-7007

INTRODUCTION

Presently the Washington Division of Geology and Earth Resources is developing a systematic database of inactive and abandoned metal mines (Norman, 2000). Previous work by the Division has had a distinctly commodity-oriented focus (Hunting, 1956; Derkey, 1990). Our current goal is to build a single database and geographic information system (GIS) characterizing the largest of the state's inactive and abandoned mines. Documentation will focus on physical characteristics, possible hazards (openings, structures, materials, and waste), and water-related issues (acid mine drainage and/or metals transport). Accurate location, current ownership, and land status information will be included. Acquisition of this information is a critical first step in any systematic approach to determine if remedial or reclamation activities are warranted. Open-file reports (OFR) will provide written documentation on mines or groups of mines within specific mining districts or counties.

Over 3,800 mineral properties have been located in the state during the last 100 years (Hunting, 1956; McFaul and others, 2000). Many are undeveloped prospects of little economic importance. Therefore, we have selected approximately 60 sites for site characterization. These sites meet one of the following criteria: (a) more than 2,000 feet of underground development, (b) more than 10,000 tons of production, (c) location of a known mill site or smelter. This subset of sites includes only metal mines no longer in operation.

We have chosen to use the term *inactive* in the project's title in addition to the term *abandoned* because it more precisely describes the land-use situation regarding mining and avoids any political or legal implications of surrendering an interest to a property that may re-open with changes in economics, technology, or commodity importance.

Creation of the state-managed IAML database is a cooperative effort between the Washington State Department of Natural Resources (DNR), the U.S. Forest Service (USFS), the U.S. Bureau of Land Management (BLM), the U.S. Environmental Protection Agency (EPA), and the Washington Department of Ecology (DOE). DNR's Division of Geology and Earth Resources (DGER) is the lead agency. To date, USFS contracts have been the principal source of funding, with other contributions coming from DNR and EPA.

SUMMARY

Mining at the Roy and Barnum-McDonnell mines took place in contiguous portions of secs. 6 and 7, T12N, R5E, 2 miles southeast of Morton, Washington, on the Davis Lake Road (Fig. 1). The mines yielded a total of \$509,717 (historic value) of mer-

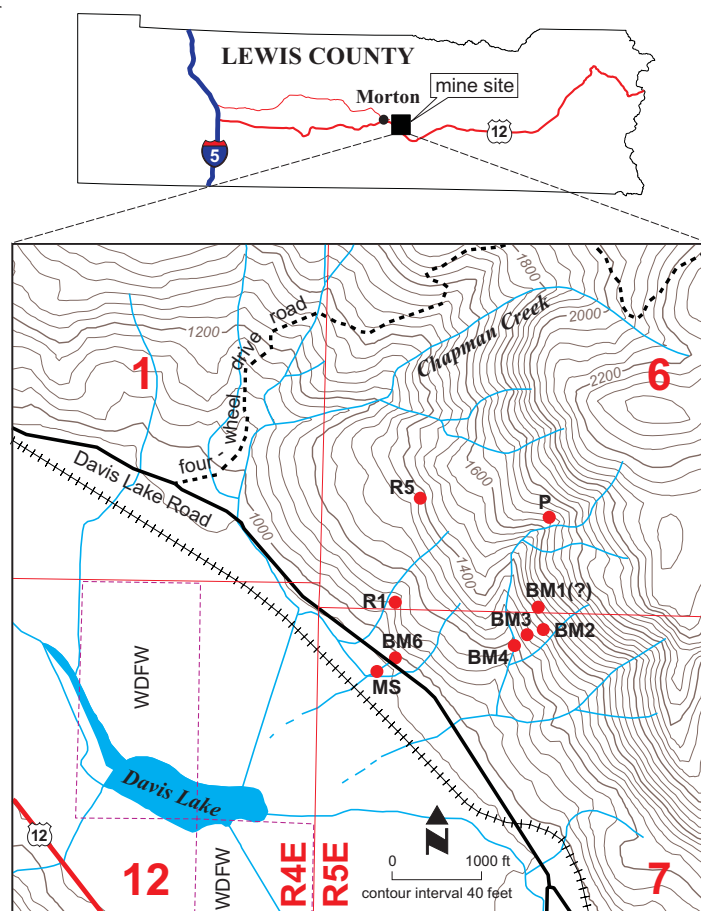


Figure 1. Site map of the Roy and Barnum-McDonnell mines, Morton Cinnabar Mining District, Lewis County, Washington. R, Roy adit; BM, Barnum-McDonnell adit; P, Parmenter tunnel; MS, mill site; WDFW, Washington Department of Fish and Wildlife land.

cury during intermittent periods of production from 1926 to 1940, with the peak year being 1929 (Mackin, 1944). The Morton District had the most significant mercury production in the state (Hunting, 1956). Cinnabar mineralization, probably related to the emplacement of subsurface igneous bodies, occurred in discontinuous lenses and brecciated zones in Eocene Puget Group sandstone and shale sediments (Mackin, 1944).

The combined development work, including adits and production stopes on both properties, totaled 9,400 feet on ten levels (Hunting, 1956). Leasing took place during a spike in mercury commodity prices during the late 1950s and early 1960s (DGER mine file, 1958). Production, if any, from this later activity is undocumented. For practical purposes, the mines have been inoperative since 1940.

Various retort furnaces operated on the properties between 1914 and 1940. A 300-ton/day flotation mill, constructed at the mouth of the Barnum-McDonnell no. 6 haulage tunnel, was dis-

mantled in 1943 after a few test runs and failure to find additional ore reserves.

The area is currently owned by a number of private parties, one corporation, and the City of Tacoma (lands managed by the Washington Department of Fish and Wildlife [WDFW]) (Fig. 1). It was previously held by mining companies as mineral lode claims. The smaller parcels on Davis Lake Road are residential sites. The larger (quarter section) parcels in sec. 6 are used as pasture and timberland.

We conducted field investigations on Oct. 11, 2000 (with DOE), May 9, 2001, and July 5, 2001. There was no evidence of current mining or milling activity. No hazardous machinery, materials or tailings were discovered.

Waste rock dumps contiguous to adits are composed of unmineralized shale or sandstone and support thick vegetation including Douglas fir as much as 30 inches in diameter.

We observed the following potentially hazardous openings and subsidence features:

- Subsidence feature 1, a 45-foot-diameter hole, extends into the edge of the four-wheel-drive road at 122.23167 longitude and 46.54628 latitude ($N\frac{1}{2}NE\frac{1}{4}NW\frac{1}{4}$, sec. 7) and blocks it to passenger vehicle travel. The hole appears to have obscured the portal of Barnum-McDonnell adit 2 (Mackin, 1944).
- Subsidence feature 2, a vertical opening 10 feet in diameter and approximately 26 feet deep, lies in the bed of the road approximately 30 feet north of the subsidence feature described above (Fig. 2). It lies on the centerline of Barnum-McDonnell adit 2 (Mackin, 1944).
- A 10-by-12-foot open adit at 122.23153 longitude and 46.54975 latitude ($SE\frac{1}{4}SW\frac{1}{4}$ sec. 6) has a large unsupported sandstone overhang at the entrance. Slabs have calved off in the past, and timbers, which once may have provided support, appear to be deteriorated (Fig. 3). This opening dates to 1960 during leasing activity by a contractor using a front-end loader (Sidney Beck, landowner, oral commun., 2001). Its length is unknown. It lies 25 feet southeast of what appears to be the caved Parmenter adit, circa 1935 (Mackin, 1944, plate 1; online photo 1640). (Online photos may be viewed at <http://www.wa.gov/dnr/htdocs/ger/iaml/01-1/>).
- All other mine-related openings observed have collapsed to the point of preventing entry (Fig. 4). No openings were entered during field investigations.

Two concrete structures are situated on the site of the circa-1940 flotation mill, 50 feet south of Davis Lake Road. The first, an above-ground structure, appears sound, but presents a hazard to anyone attempting to climb into or around it (Fig. 5), as does the second structure, a subgrade concrete sump that is partly obscured by surrounding blackberry bushes.



Figure 2. Subsidence feature 2, a vertical opening 26 feet deep on Barnum-McDonnell access road.



Figure 3. Loren Baker at the 10-by-12-foot open adit near the Parmenter tunnel.

Davis Lake Road appears to have been constructed over the portal of the 1,400-foot main haulage tunnel (adit 6) of the Barnum-McDonnell mine. A 36-inch culvert lies beneath the road at the former location of this adit (DGER mine map file). Discharge from this culvert was 15 gallons/minute in October of 2000.

We (DNR and DOE personnel) collected water samples at six locations. Concentrations of selected metals were not at detectable levels in our samples, and all samples met the criteria for domestic consumption of ground water given in the Washington State Department of Health water quality standards (WAC 246-290).



Figure 4. The condition of Roy adit 5 is similar to that of all other mine-related openings observed. The caved adit is indicated by the large arrow to the right. Note the hammer (small arrow to left) for scale. (See online photo 1430.)

Soil samples taken from mine waste rock dumps contained less than 100 parts per million elemental mercury. A sample taken from the material inside the above ground concrete structure at the flotation mill site contained 980 part per million mercury (Fig. 5). No sample exceeds the Model Toxics Control Act (MTCA) clean-up limits for this analyte for industrial soil.

GENERAL INFORMATION

Names: Roy mine (also known as Fisher, Morton, or Gillespie mine); Barnum-McDonnell mine

Status of mining activity: none; land used for non-mining purposes

Claim status: closed; no ORMC number (BLM Oregon Mining Claim number used to identify claims in both Washington and Oregon) or DNR permit number

Current Ownership

Roy mine (sec. 6, T12N R5E)

1. Sidney Beck
(Lewis County tax parcels 030386000000, 030387000000)
2. Rayonier Timberlands Operating Co.
(Lewis County tax parcel 030389000000)
3. Campbell Group LLC
(Lewis County tax parcel 030379001000)

Barnum-McDonnell mine (sec. 7, T12N R5E)

1. Sidney Beck
(Lewis County tax parcels 030399000000, 030398001005)
2. Dawn P. Moon and others (Sargent property)
(Lewis County tax parcels 030398001006, 030398001004)
3. Charles E. Ingalsbe
(Lewis County tax parcel 030398000000)
4. R. A. Schindler and others
(Lewis County tax parcel 030398003000).
5. City of Tacoma
(Lewis County tax parcel 030398010000, managed by the Washington State Department of Fish and Wildlife as the Davis Lake Wildlife Refuge)

Surrounding land ownership: Private parties, corporations, City of Tacoma

Location

Mine name	County	Mine location	1:24,000 map	1:100,000 map	Decimal longitude	Decimal latitude
Roy	Lewis	sec. 6, T12N R5E	Glenoma	Centralia	122.23274	46.54803
Barnum-McDonnell	Lewis	sec. 7, T12N R5E	Glenoma	Centralia	122.23397	46.54630

Directions

From Interstate 5, drive east on State Route 508 to Morton. Continue east through town, access Davis Lake Road, and proceed east 2.5 miles. The inactive mine sites lie to the north of Davis Lake Road; the mill site is on the south side of the road. Secure



Figure 5. Concrete structure 1 at the mill site. (See online photos 1422, 1424, and 1426.)

Table 1. Mine features. BM, Barnum-McDonnell mine; R, Roy mine; ---, no data; *, numbered photos online at <http://www.wa.gov/dnr/htdocs/ger/iaml/01-1/>

Description	Condition	Fenced (yes/no)	Length (feet)	Width (feet)	Height/depth (feet)	True bearing	Elev. (feet)	Decimal longitude	Decimal latitude	Digital photo*
BM1 adit	caved	no	---	---	---	N85°E	1420	122.23194	46.54696	1412
BM2 adit	caved	no	---	---	---	N8°E	1339	122.23167	46.54628	1411
subsidence feature 1	blocks access road	no	45	45	20	---	1400	122.23167	46.54628	1410, 1411
subsidence feature 2	vertical opening in bed of access road	no	10	10	26	---	1400	122.23167	46.54628	1409, 1410, Fig. 2
BM3 adit	caved	no	---	---	---	N45°E	1260	---	---	1415
BM4 adit	caved	no	---	---	---	N50°E	1200	122.23294	46.54577	1404
BM6 adit	drains through culvert beneath Davis Lake Road	no	---	---	---	N80°E	981	122.23842	46.54531	1428
R1 adit	water impounded	no	---	3	1	N45°E	1180	122.23831	46.54702	1439, 1440, 1441
R5 adit	caved, wet	no	---	---	---	N85°E	1380	122.23729	46.55027	1430, Fig. 4
open adit at Parmenter site	rotted timbers inside; sandstone slabs overhang entrance	no	---	12	10	E	1650	122.23153	46.54975	1641, 1642, 1643, Fig. 3
concrete structure 1	above ground columns and girders intact	no	15	40	12	---	980	122.23842	46.54531	1422, 1424, 1426, Fig. 5
concrete structure 2	below grade sump	no	15	15	8	---	980	122.23842	46.54531	1418

permission from landowners or their representatives before proceeding.

Mine Operations Data

Type of mine: underground with mill and retort

Commodity mined: mercury (Hunting, 1956)

Geologic setting: Eocene Puget Group sediments consisting of folded and faulted sandstone, shale and interbedded coal seams are intruded by Eocene basic sills and dikes (Schasse, 1987). The folding and faulting occurred during the Tertiary Period (Gard, 1968). Ore mineralization was controlled by varying degrees of permeability within the sediments and localized in brecciated zones along fault planes (Mackin, 1944).

Ore minerals: cinnabar (Hunting, 1956)

Non-ore minerals: pyrite, calcite (Hunting, 1956)

Host rock: sandstone, siltstone, and shale (Hunting, 1956)

Overall period of production: 1926–1940 (Mackin, 1944). Exploration activity in early 1960s resulted in little or no production.

Development: 9,400 feet total on ten levels (Hunting, 1956)

Production: \$509,717 (Mackin, 1944)

Mill data: A 300 ton/day flotation mill was constructed at the mouth of the Barnum-McDonnell haulage tunnel (Fig. 1, BM6) in 1940, but was dismantled in 1943 (Mackin, 1944). From 1914 to approximately 1940, at least seven different retort furnaces were used on the properties. Capacities ranged from 4 to 100 tons/day (Johnson, 1936; DGER mine files).

PHYSICAL ATTRIBUTES

Features: see Table 1

Materials: No mining-related materials were observed during site visits.

Machinery: No mining-related machinery was observed during site visits.

Structures: The remains of the flotation mill (circa 1940) lie immediately downslope of the BM6 tunnel at an elevation of 980 feet at Davis Lake Road milepost 2. A 15-by-40-by-12-foot tall skeletal concrete structure stands on the south side of, and is visible from, the Davis Lake Road (concrete structure 1; Fig. 5; online photos 1422, 1424, 1426). This feature appears sound, but presents a hazard to anyone attempting to climb into or around it. A deteriorating 15-by-15-foot concrete foundation lies 100 feet to the northwest (concrete structure 2; online photo 1418). This structure extends 8 feet below grade, and 4-inch pipes extend into it.

Table 2. Analysis of tailings and dumps. BM, Barnum-McDonnell mine; Roy, Roy mine; ---, no data; ¹, not detected above test limit shown here; ², Model Toxics Control Act cleanup level for mercury in soil, method B (Washington Department of Ecology, 1994); *, numbered photos online at <http://www.wa.gov/dnr/htdocs/ger/iaml/01-1/>

Description	Mercury (µg/kg)	Estimated quantity (yd ³)	Decimal longitude	Decimal latitude	Digital photo*
BM3 waste rock dump	0.34	~900	---	---	1416
BM4 waste rock dump	≤1.7 ¹	<50	122.23294	46.54577	1406
retort area adjacent to R5 waste rock dump	100	<50	122.23799	46.55016	1436
Parmenter area dump	---	500	122.23153	46.54975	---
concrete structure 1	980	<20	122.23842	46.54531	1647
standard, residential ²	24				
standard, industrial ²	1050				

Table 3. Surface water field data. BM, Barnum-McDonnell mine; R, Roy mine; — — —, no data; ¹, unpublished data collected by Robert L. Raforth, Washington State Department of Ecology, Water Quality Division (low flow, Oct. 11, 2000; high flow, April 3, 2001); *, numbered photos online at <http://www.wa.gov/dnr/htdocs/ger/iaml/01-1/>

Sample location	Discharge (gpm)	Conductivity (μS)	pH	Bed color	Temp. (°F)	Elev. (feet)	Decimal longitude	Decimal latitude	Digital photo*
stream at R5 adit	2	47	6.0	natural	49	1440	122.23724	46.55027	1431
R5 adit below dump	2	— — —	6.0	natural	49	1380	122.23724	46.55027	1433
R1 adit	8	— — —	6.0	natural	49	1180	122.23831	46.54702	1439
downstream from BM mill site	10	525	6.0	natural	53	960	122.23963	46.54497	1644
stream at BM4 adit	525	— — —	6.0	natural	49	1200	122.2329	46.54577	1406
Chapman Creek headwaters, high flow ¹	18	33	6.6	natural	43	2120	122.22633	46.55553	— — —
Chapman Creek headwaters, low flow ¹	12	32	7.2	natural	50	2120	122.22633	46.55553	— — —
downstream from BM6 mill site, high flow ¹	18	524	7.4	natural	50	1120	122.23719	46.54546	— — —
downstream from BM mill site, low flow ¹	15	569	7.3	natural	50	1120	122.23719	46.54546	— — —

Presence of unstable slopes, walls, waste rock, tailings, or impoundments: The hummocky ground around caved adits BM1 and BM2 and subsidence features 1 and 2 (Table 1) shows cracks and slumping (online photos 1411 and 1414). A 3-by-9-foot boulder recently rolled 30 feet between switchbacks on the road accessing this area. The “Barnum B” and “Black Wall” projected faults intersect here (Mackin, 1944, plate 1). The Roy and Barnum-McDonnell mine lands lie in both the depletion and accumulation zones of deep-seated landslides (Dragovich, 1995). A local resident attributed some caving on the site to the Feb. 28, 2001, magnitude 6.8 Nisqually earthquake. The walls of subsidence feature 2 are vertical and unsupported.

Waste rock dumps, consisting of sandstone and decomposed-shale blasted rock, are covered with vegetation. None has a slope ratio greater than 1.5 horizontal to 1 vertical. Online photo 1429 shows a typical waste dump.

The overhang at the Parmenter tunnel opening presents slabs of unsupported sandstone (Fig. 3).

A low berm at the portal to Roy adit 1 impounds an unknown volume of water. The likelihood of failure of this feature is unknown.

No tailings were discovered on the site.

Analysis of tailings and dumps: see Table 2

Table 4. Surface water analysis. Metal concentrations are μg/L, uncorrected for hardness; hardness is in mg/L. ≤ or <, indicates metal was not detected; the number following is the practical quantitation limit above which results are accurate for the particular analysis method—the metal could be present in any concentration up to that limit and not be detected. *, unpublished data collected by Robert L. Raforth, Washington State Department of Ecology, Water Quality Division (low flow, Oct. 11, 2000; high flow, April 3, 2001)

PART 1: ANALYSIS BY USEPA METHOD 6010, INDUCTIVELY COUPLED PLASMA							
Sample location	Arsenic	Copper	Iron	Lead	Mercury	Zinc	Hardness
stream at R5 adit	≤10	≤10	260	≤10	≤0.2	≤10	17
R5 adit below dump	≤10	≤10	180	≤10	≤0.2	≤10	33
stream at R1 adit	≤10	≤10	≤100	≤10	≤0.2	≤10	45
stream at BM4 adit	≤10	≤10	150	≤10	≤0.2	≤10	47
PART 2: ANALYSIS BY USEPA METHOD 6020, INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY*							
Sample location	Arsenic	Copper	Iron	Lead	Mercury	Zinc	Hardness
Chapman Creek headwaters, high flow	<0.2	0.13	<20	<0.02	<0.002	0.28	8.94
Chapman Creek headwaters, low flow	<0.5	0.22	<20	<0.02	0.002	<0.4	11.1
downstream from BM flotation mill site, high flow	<0.2	0.49	22	0.03	<0.002	0.88	248
downstream from BM flotation mill site, low flow	<0.5	0.841	23	0.089	<0.002	1.3	284
PART 3: APPLICABLE WASHINGTON STATE WATER QUALITY STANDARDS							
Type of standards (applicable Washington Administrative Code)	Arsenic	Copper	Iron	Lead	Mercury	Zinc	Hardness
Surface water standards (WAC 173-201A, Standard for aquatic life in surface freshwater, chronic level maximums at 100 mg/L hardness)	190	11.4	none	2.5	0.012	104	100
Ground water standards (WAC 246-290, Washington State Department of Health, standards for ground water, domestic consumption)	50.0	1300	300 (cosmetic only)	15	2.0	5000	— — —

Reclamation activity and status: The most recent logging of the Roy mine area occurred circa 1980. Since then, the property has been used for reforestation and pasture land (Sidney Beck, landowner, oral commun., 2001). The higher elevations (>1,260 feet) of the Barnum-McDonnell mine land, which are not used for residence and storage, support a large stand of hemlock and Douglas fir.

VEGETATION

The site is covered by thick, healthy appearing vegetation. Plants observed include: blackberry, devil's club, grasses, fern, western hemlock, western red cedar, red alder, Douglas fir, vine maple, big leaf maple, rushes, willow, horsetail, and osoberry.

WILDLIFE

We observed no bats or bat evidence. We detected no air flow at any opening. Deer droppings were found at scattered locations.

WATER QUALITY

Surface waters observed: Chapman Creek, Davis Lake and associated wetland (WDFW), and intermittent streams

Proximity to surface waters: 0.6 mile from Chapman Creek (west) and 0.6 mile from Davis Lake (southwest). Intermittent streams pass through site.

Domestic use: Water draining from and/or around Roy adit 1 enters a 2-inch plastic pipe leading toward a mobile home above Davis Lake Road.

Acid mine drainage or staining: none

Water sample data: see Table 3

Water sample results: see Table 4

ACKNOWLEDGMENTS

We are grateful to Bob Raforth of the Washington State Department of Ecology, Water Quality Division, for his helpful assistance and permission to reproduce his data. We thank Loren Baker for his assistance in the field and Sidney Beck, landowner, for a guided tour of the mine property. And most importantly, we thank our editor, Jari Roloff, without whom this publication would not be possible.

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Appendix

PHOTOGRAPHIC DOCUMENTATION

Photos (JPEG format) listed in tables and photo log may be found on our website at <http://www.wa.gov/dnr/htdocs/ger/iaml/01-1/>.

METHODS

We recorded observations and measurements in the field. Longitude and latitude were recorded in NAD83 decimal degree format. Literature research provided data on underground development, which was verified in the field when possible.

All water samples were collected as simple grab samples in pre-cleaned 500 mL HDPE bottles with preservative and kept on ice for transport to Sound Analytical Services, Inc. (SAS). Soil samples from dumps or tailings were taken from subsurface material and double bagged in polyethylene. Chain of custody was maintained.

Water and soil samples were analyzed for arsenic, cadmium, copper, iron, lead, and zinc by inductively coupled plasma/mass spectrometry (ICP/MS) following USEPA Method 6010. Sam-

ples were analyzed for mercury by cold vapor atomic absorption (CVAA), USEPA Method 7470 (water), and Method 7471 (soil).

Holding times for the metals of interest were observed (28 days for mercury, 180 days for other metals). Instrument calibration was performed before each analytical run and checked by standards and blanks. Matrix spike and matrix spike duplicates were performed with each set.

FIELD EQUIPMENT

Garmin GPS III+, handheld GPS unit
Litmus paper, range 0–14, and 4–7
Hanna Instruments DiST WP-3 digital conductivity meter
and calibration solution
Taylor Model 9841 digital thermometer
barometric altimeter
digital camera
binoculars
flashlight